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		First Named Inventor	Mark Ahmadjian et al
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		Examiner Name	A. Kim
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Firm or Individual name	THOMAS C. STOVER, Reg. No. 22,531	
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Air Force Invention No. AFB00500

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of
Mark Ahmadjian et al
Serial No. 09/862,788
Filed: 18 May 2001
For: **PLUME DETECTOR**

Group Art Unit: 2876
Examiner: A. Kim

Honorable Commissioner for Patents
Washington D. C. 20231

Sir:

Amendment

In response to the Office Action dated 3 -- 11 - 04, please amend the above application by adding claim 16 to the pending claims listed below.

In The Claims

1 (*previously presented*): A rocket plume detector comprising:

- a) a passive electro-optical sensor for detecting narrow band spectral emissions in a rocket engine plume, including through clouds and

detection, said sensor being mounted on an above-flying or orbiting platform.

2 (*previously presented*): The detector of claim 1 wherein said sensor isolates the rocket plume wavelength of interest selected from the group of aluminum, aluminum perchlorate, carbon dioxide, carbon monoxide, copper, copper hydride, hydrogen chloride, hydroxyl, methane, mon-methyl hydrazine, nitric acid, nitric oxide, nitrogen dioxide, nitrous oxide, polybutadiene, potassium, sodium, sulfur dioxide, and water to detect a rocket launch plume.

3 (*previously presented*): The plume detector of claim 1 wherein said platform is an aircraft or an orbiting satellite.

4 (*previously presented*): The detector of claim 3 which includes a narrow band filtered radiometer when carried on said aircraft or includes a spectrographic imager when carried on said satellite or vice versa.

5 (*previously presented*): The plume detector of claim 2 wherein said sensor can spectrally isolate or detect the emission wavelength of interest in the plume of a rocket being launched through fog, clouds and other water vapor.

6 (*previously presented*): The plume detector of claim 5 wherein said sensor can spectrally detect the emission wavelength of Na or K in a rocket engine plume.

7 (*previously presented*): The detector of claim 1 wherein said sensor has

- a) a narrow band filtered photometer,
- b) data acquisition electronics and
- c) a computer to monitor & record resulting data.

8 (*previously presented*): The plume detector of claim 1 comprising

- a) collection optics for plume emissions,

- b) a focal plane assembly which includes a spectral filter,
- c) data acquisition avionics,
- d) a global positioning system (GPS) receiver and
- e) a computer for receiving the detector data signal and the GPS data for data acquisition, storage, processing and display.

9 (*previously presented*): The plume detector of claim 8 wherein said focal plane assembly includes a photomultiplier and said spectral filter serves to pass the emission of interest and to reject the background emission.

10 (*previously presented*): The plume detector of claim 8 wherein said GPS receiver records the flight path of the detector platform.

11 (*previously presented*): The plume detector of claim 8 wherein a 10-nm-wide or spectral filter suitable for nighttime emission detection is replaced with a 0.005 nm atomic line filter (ALF) for daytime emission detection.

12 (*previously presented*): The plume detector of claim 3 employing ultraviolet and visible imagers and spectrographic imagers as a UVISI sensor on-board said satellite platform, to measure from space, a ground-based Na emission source or to measure from space, the emission of interest in the plume of a rocket being launched.

13 (*previously presented*): The plume detector of claim 3 employing a sensor with a narrow band spectral filter at a wavelength that is radiated through clouds.

14 (*previously presented*): The plume detector of claim 3 adapted to employ a plurality of filters, radiometric or spectrometric, which detector is tunable to a desired rocket plume emission wavelength.

15 (*previously presented*): The rocket plume detector of claim 14 being suited for both

15 (*previously presented*): The rocket plume detector of claim 14 being suited for both missile detection and characterization.

16 (*new*): A method of detecting a rocket plume comprising:

- a) employing a passive electro-optical sensor for detecting narrow band spectral emissions in a rocket engine plume, including through clouds and
- b) employing a lock-in amplifier to reduce background radiation for enhanced plume detection, said sensor being mounted on an above-flying or orbiting platform.

REMARKS

Claims 1 -- 16 are in the present application.

Claim 16 is a new method claim, based on claim 1 and defines a two-step method not suggested by a combination of the three references cited below. Accordingly, claim 16, per its steps a) & b), is believed distinguished over the prior art by its two-way or dual filtering plume detection system, compared with the one-way or spectral emissions plume detection by the references cited below.

The Office Action rejection under 1 -- 9 and 11 -- 15, as obvious under 35 U.S. 103 (a) over Hill Jr. et al ('285), in view of Hasson et al ('452) and Hertel et al ('531), is respectfully traversed. While the first two references disclose detecting spectral emissions (at spectral frequencies) in an engine plume, they do not detect the fluctuation frequency of a signal.

That is, the Hill reference, e.g., in cols. 5 & 6, can detect spectral frequency differences, i.e., can distinguish the sodium spectrum line from the potassium spectrum line, as indicated in Hill in col. 6, lines 33-46.

However, since neither Hill nor Hasson suggest the use of a lock-in amplifier,

they cannot detect fluctuation frequency differences between, say, a sodium lamp that fluctuates at 60 hertz and sodium in a rocket plume that fluctuates at, e.g., 50 hertz.

Further, Hill et al rely upon stimulated emission at all times and cannot accurately and quickly send a laser beam down through clouds (due to beam dissipation & reflection) to find a rocket plume and then read same back, e.g., by sensor 110 of Hill's Figure 3.

As for Hertel et al, per its Figure 1, it also relies upon stimulated emission, i.e., by two or more laser beams, which pass-through or intersect in a gaseous or liquid medium, having particles, which scatter such light, which then continues onto a like number of detectors to measure size, shape and the like of particles in the carrier medium. Such detectors 5 are conveniently located on the other side of the medium to detect the scattered light of said laser beams.

However, in rocket plume detection, the detectors are not so conveniently located, i.e., below a cloud cover, so that the Hertel laser beams run into the same problem as noted above for Hill et al, in that they cannot accurately or quickly send a laser beam down through clouds (due to beam dissipation and reflection), find a rocket plume and then read same back by a sensor, the such as sensor 5, which should be located up near light sources 4, per Hertel's Figure 1.

That is, Hertel employs lock-in technology within the setup shown in its Figure 1 to match scattered light signals with a light source, per its col. 5, lines 43 -- 47. By this method, Hertel can determine which light source 4 is sending scattered light signals to which detectors 5. There's no suggestion by Hertel of employing a lock-in amplifier to detect fluctuation frequency differences between a sodium lamp at 60 hertz and sodium

in a rocket plume at 50 hertz. That is, the Hertel detector is in the wrong position for plume detection and the laser beam emitted from light source 4, would have difficulty penetrating a cloud cover, as discussed above.

Thus, the Hertel reference does not suggest employing a lock-in amplifier for plume detection and discrimination through clouds (e.g., per applicants' claims 1 & 16) unless one has in view applicants' own disclosure. This is hindsight reconstruction which does not establish obviousness, In re Civitello, 144 USPQ 10.

As for the Hasson reference, while this patent is directed to passive detection of a luminous target, it discloses an airborne system 10, wherein the target 12 is a rocket emitting a plume which is a source of radiation reflected (via rays 100) from cloud 98, to be viewed by the system 10, per lines 59 -- 67, in col. 5 and lines 1 -- 3 in col. 6. That is, this system discloses detecting only light reflected off a cloud rather than through a cloud, in its own words and also with no suggestion of employing a lock-in amplifier to distinguish between a sodium lamp at 60 hertz and sodium in a rocket plume at 50 hertz.

Thus none of the above three references suggest employing a lock-in amplifier to distinguish rocket plume emissions through clouds, nor is the combination of Hertel with the above two references suggested except by applicants' own disclosure.

That is, to establish a *prima facie* case of obviousness:

1. There must be some suggestion or motivation in the references to combine reference teachings;
2. There must be a reasonable expectation of success and
3. The prior art references, when combined, must teach or suggest all of the claim limitations. The teaching or suggestion to make the claimed combination and the

reasonable expectation of success, must both be found in the prior art and not be based on applicants' disclosure; In re Vaeck, 20 USPQ 2nd 1438 (1991), as noted in MPE P 706.02(j).

Note that Hertel et al employ a plurality of light sources which would require a like number of lock-in amplifiers and further disclose detectors on the opposite side of a cloudy medium, per its Figure 1, so that a different structure is disclosed which does not suggest applicants' claimed structure of a single passive detector above the cloud cover, with a single lock-in amplifier, also above such cloud cover. That is, applicants' invention as claimed, provides a detector that separates a modulated signal from its background for, e.g., readily distinguishing a sodium rocket plume from a sodium street lamp.

Likewise, applicants' claims, 2-15 are believed distinguished over the above applied references in view of their dependence from claim 1, which is believed novel thereover, as discussed above.

In view of the foregoing, the claims of record, are believed distinguished over the applied references and in condition for allowance.

In accordance with Section 714.01 of the M.P.E.P., the following information is presented in the event that a call may be deemed desirable by the Examiner: to Thomas C. Stover, (781) 377-3779.

Respectfully submitted,



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